

FAUNAL COMPOSITION AND SEASONAL DISTRIBUTION OF
TABANIDS IN THREE GEOGRAPHIC REGIONS
OF EASTERN TENNESSEE
(DIPTERA: TABANIDAE)

BRADLEY A. MULLENS¹ AND REID R. GERHARDT²

Department of Agricultural Biology, University of Tennessee, Knoxville,
Tennessee 37901.

Abstract.—Tabanid studies were conducted during 1977 and 1978 at 4 locations in 3 major geographic regions of Tennessee: the Cumberland Plateau, the Tennessee Valley, and the Blue Ridge Mountains. Primary collecting tools were modified Manitoba canopy traps and hand nets. Faunal composition varied greatly among the areas. *Tabanus quinquevittatus* Wiedemann was dominant in locations near large areas of moist pasture, with *Hybomitra difficilis* (Wiedemann) a dominant species in upland areas. Many species were prevalent only in high altitude regions, but most species common at low altitudes were also fairly common in the upland locations. A total of 22,596 tabanids in 66 species and 9 genera was collected, and 4 species and one genus are new state records. The largest numbers of individuals and species were collected in late June and early July in most areas. An early population peak occurred in late May, and a minor peak occurred in late August and September. Seasonal distribution data for some major species are discussed.

Studies of Tabanidae in Tennessee are limited. Pechuman (1954) reported the seasonal distribution of 25 species and 1 subspecies of Tabaninae collected from Morgan County. Snow et al. (1957) published collection records for 51 species and 7 subspecies of Tabanidae from the Tennessee Valley watershed. Smith et al. (1965) collected 40 species and one subspecies of Tabanidae while surveying the Land Between the Lakes area of northwestern Tennessee. Goodwin (1966) listed 81 species and 5 subspecies of

¹ Former graduate research assistant. Current address, Department of Entomology, Cornell University, Ithaca, New York 14853.

² Associate Professor.

Tabanidae known from the state at that time. The number of species now known from Tennessee is 99 plus 3 subspecies in 15 genera (Mullens, 1979).

In addition to Pechuman's brief 1954 study, seasonal distribution studies by Burnett and Hays (1977) in Alabama and Sheppard (1972) in South Carolina have some relevance to tabanid population trends in Tennessee.

This study was conducted in 1977 and 1978 to determine the tabanid faunal composition in selected areas of Tennessee and to gather seasonal distribution data for these species.

MATERIALS AND METHODS

The principal tabanid survey tools were Manitoba canopy traps modified from those used by Pechuman (1972). Trap height was 2 m with a 77 cm clearance between the canopy and the ground. A glossy, black ball 33 cm in diameter was suspended below the canopy and 25 cm above the ground as a visually attractive decoy. These traps were erected in 4 study areas, and collections were made weekly. A portable two-way malaise trap, 2 m tall and 2.5 m long, modified from Drees (1977) was used occasionally. Sticky panel traps (Dale and Axtell, 1976) were erected and examined weekly in 1978 at Grasslands Farm, Cumberland County, and Rafter, Monroe County. Other collecting methods included overhead netting, netting from cattle and horses, and capturing specimens that flew into the truck cab. Netting around a host (especially the collector himself) was particularly useful in sampling the *Chrysops* population. Identifications were made by the senior author according to Pechuman (1973). Difficult determinations and representative specimens of all species were sent to Dr. L. L. Pechuman, Cornell University, Ithaca, New York for positive identification.

Four study areas were selected to represent the three major geographic regions in eastern Tennessee: the Cumberland Plateau, the Tennessee Valley, and the Blue Ridge Mountains. The Cumberland Plateau extends from northern Alabama to Pennsylvania and has an average elevation in the study area of 615 m. The plateau is characterized by steep, rolling hills, and upland forests are dominated by oaks (*Quercus* spp., especially *Q. alba* L.), hickories (*Carya* spp.), other hardwoods, and some pines (*Pinus* spp., especially *P. virginiana* Miller and *P. echinata* Miller). Moist forest areas are dominated by mixed mesophytic forest (Braun, 1964), and many sandstone slopes are dominated by a shrub layer of mountain laurel (*Kalmia latifolia* L.) and *Rhododendron maximum* L. Dogwood (*Cornus florida* L.) is a common understory tree throughout the state. Alder (*Alnus* spp.) is present in moist drainages.

Grasslands Farm, Plateau Experiment Station, Cumberland County, on the Cumberland Plateau, consists of approximately 600 ha, half of which is pasture, and is used for beef cattle studies. Several streams and numerous

farm ponds with emergent vegetation such as cattail (*Typha latifolia* L.) are on the property, as are pasture drainages with large areas of wet pasture interspersed with *Juncus* spp. During 1977 four canopy traps were erected in the open near ponds on 18 March and were monitored until 16 September (two traps) or 29 September (two traps). During 1978 all traps were operated from 11 April until 10 October.

The Tennessee Valley extends from southwestern Virginia south into northern Alabama and lies between the Cumberland Plateau and the Blue Ridge Mountains. Altitude generally ranges from 250–275 m in the study area. Mixed forest areas are dominated by oaks and hickories, but some bottomland areas have small areas of mixed mesophytic forest. Tabanidae were collected from several Knox County locations close to Knoxville, which lies in the center of the Tennessee Valley. Most specimens were taken in a canopy trap erected near a pond on the grounds of Johnson Bible College. The rolling terrain around the trap is mostly pastureland with some woodland and moist drainages. Cattle and a pony grazed nearby. This trap was operated from 5 May to 12 October 1978. Additionally, numerous periodic net collections and some trap collections were made at Cherokee Woodlot, a low-lying area, during 1977 and 1978. Cattail and sweet flag (*Acorus calamus* L.) are prevalent here in moist drainages. Some other net collections were made in nearby areas.

Ball Play, Monroe County (elev. 260 m) lies at the edge of the Tennessee Valley and is a transition zone adjacent to the Blue Ridge Mountains. The rolling terrain has considerable pastureland and cropland, with numerous farm ponds and creeks. Vegetation is similar to that of Knox County, with somewhat more yellow-poplar (*Liriodendron tulipifera* L.) growth. A canopy trap was set up next to the Tellico River, a tributary of the Tennessee River, on 13 April 1977, was moved slightly in mid-June to a pasture edge, and was dismantled on 20 September. In 1978 it was operated in a slightly different location on a small creek in the same area from 13 April to 12 October. Both locations were near tree lines and grazing cattle and horses. None of the sites were over 100 m apart.

Rafter, Monroe County, an area in the Blue Ridge Mountains, has an elevation of approximately 460–500 m. Only 10 km from Ball Play, the area has steep, densely forested mountainsides with ubiquitous creeks, springs, and drainages. Small valley areas are used for subsistence farming and pastureland. Numerous overstory trees include yellow-poplar, hemlock (*Tsuga canadensis* L.), beech (*Fagus grandifolia* Ehrhart), oaks, and black locust (*Robinia pseudoacacia* L.). The understory is dominated by dogwood and thickets of rhododendron, mountain laurel, and *Leucothoe* spp. A single canopy trap (Rafter 1) was operated from 7 April to 20 September 1977 in a narrow 5 ha pasture which was grazed by several cows. Several springs containing watercress (*Nasturtium officinale* R. Brown), sweetflag, and cattail flow

into a stream at one end of the field. During 1978 a trap was operated at the same location from 13 April to 12 October. Additionally, another trap (Rafter 2) was erected in a 20 ha valley across a ridge southwest of the original site. It was operated from 27 April to 12 October.

RESULTS AND DISCUSSION

During this study, 22,596 tabanids in 66 species and 9 genera were captured and identified. Only 14 were males. A total of 3,905 was captured in 1977, while 18,891 were taken in 1978. The increased numbers in 1978 were due to several factors, including intensified collecting activity, generally better early season trap catches, and better trap location in some cases.

The species collected are listed in Table 1 in alphabetical order according to the classification of Philip (1965). New state records are indicated by an asterisk (*) preceding the species name. Collection areas are given as follows: Area I (Grasslands Farm, Cumberland Co.), Area II (Knox Co.), Area III (Ball Play, Monroe Co.), Area IV (Rafter, Monroe Co.). An "x" in the area column indicates that the species was commonly found in that area. When that species was very rarely collected (less than six/season in trap catches and rarely taken by other methods) an "O" is found in the area column. Collection dates are the earliest and latest specimens taken over both years and do not necessarily indicate a complete series, though this was often the case. For more detailed seasonal abundance information on all species, the reader is referred to Mullens (1979).

The faunal composition of the tabanid populations varied considerably. A number of species were taken exclusively or in far greater numbers at the higher altitude areas. These include *Chrysops calvus*, *C. cursim*, *Hybomitra cincta*, *H. sodalis*, *Tabanus longus*, and *T. marginalis* (Rafter) and *C. cuculux* and *H. difficilis* (Rafter and Grasslands Farm). The upland areas of the Cumberland Plateau and the Blue Ridge Mountains both extend into the northeastern U.S. An examination of range maps (Pechuman, unpublished data) indicates that, in some cases, e.g. *C. calvus* and *T. marginalis*, these collections apparently represent southward extensions or relict populations of basically northern species. The single specimen of *H. typhus*, which is also a predominantly northern species, was taken at Grasslands Farm. Other species, such as *H. sodalis*, were found in the Tennessee Valley but were much more common in upland situations. *Chrysops moechus* and *C. pikei* were more common in the Tennessee Valley (Ball Play). The new state record for *Whitneyomyia beatifica atricorpus*, basically a southern species, is a significant northward range extension into the Tennessee Valley, which extends south into Alabama.

Most species common in the valley areas were also fairly common at higher elevations. *Chrysops callidus*, *C. macquarti*, *C. niger*, *C. univittatus*, and *C. vittatus* were common and widespread deer fly species. Among the

Table 1. Faunal Composition and Seasonal Occurrence (1977-1978) of Tabanidae in 4 Areas of Tennessee.

Species	Area				Collection Dates
	I	II	III	IV	
Pangoniinae					
<i>Stonemyia</i>					
<i>isabellina</i> (Wiedemann)	○				6/27
Chrysopsinae					
<i>Chrysops</i>					
<i>brimleyi</i> Hine	×	○	○	×	5/6-6/6
<i>callidus</i> Osten Sacken	×	×	×	○	5/7-9/12
* <i>calvus</i> Pechuman & Teskey				×	5/18-6/2
<i>carbonarius</i> Walker			○	○	6/1-6/23
<i>celatus</i> Pechuman	○			○	6/13-6/30
<i>cincticornis</i> Walker	×	×		○	5/10-6/27
<i>cuclux</i> Whitney	×			×	5/4-6/6
<i>cursim</i> Whitney				×	6/15-7/27
<i>flavidus</i> Wiedemann	○	○			5/25-9/5
<i>geminatus</i> Wiedemann		×		×	6/11-7/26
<i>impunctus</i> Krober		×		×	6/20-7/27
<i>macquarti</i> Philip	×	×	×	×	5/31-8/22
<i>moechus</i> Osten Sacken			×	○	5/27-8/3
<i>montanus</i> Osten Sacken	×				6/6-6/30
<i>niger</i> Macquart	×	×		×	5/9-6/27
<i>pikoi</i> Whitney			×		7/6-7/27
<i>pudicus</i> Osten Sacken	○			○	6/13-8/20
<i>separatus</i> Hine			○		4/7
<i>univittatus</i> Macquart	×	×	×	×	6/9-9/6
<i>vittatus</i> Wiedemann	×	×		×	6/13-8/30
Tabaninae					
<i>Chlorotabanus</i>					
<i>crepuscularis</i> (Bequaert)	○	○		×	6/20-7/18
<i>Atylotus</i>					
* <i>ohioensis</i> (Hine)			○		6/22
sp. [nr. <i>thoracicus</i> (Hine)]	○				6/12
<i>Whitneyomyia</i>					
* <i>beatifica atricorpus</i> Philip		○			6/7
<i>Leucotabanus</i>					
<i>annulatus</i> (Say)	×	○	×	×	6/29-8/17
<i>Tabanus</i>					
<i>uar</i> Philip	○				7/21
<i>abdominalis</i> F.	×		×	×	6/21-8/8
<i>americanus</i> Forster	○		○	×	5/31-8/8
<i>aranti</i> Hays		○	○	○	6/21-7/12
<i>atratus</i> F.	×	×	×	×	6/6-9/19
<i>calens</i> L.	×		○	○	7/26-9/5
<i>exilipalpis</i> Stone			○		5/25-6/15
<i>fairchildi</i> Stone		×	×	×	6/22-7/26

Table 1. Continued.

Species	Area				Collection Dates
	I	II	III	IV	
<i>fulvulus</i> Wiedemann	x	x	x	x	6/2-8/15
<i>lineola</i> F.	x	x	x	x	6/6-9/19
<i>longus</i> Osten Sacken				x	6/2-9/7
<i>marginalis</i> F.				x	5/11-6/2
<i>melanocerus</i> Wiedemann	x	x	x	x	6/7-8/29
<i>moderator</i> Stone		x	x	x	6/7-7/26
<i>molestus</i> Say	x	x	x	x	5/31-7/27
<i>molestus mixis</i> Philip	x	x	x	x	6/2-8/9
<i>nigrescens</i> Palisot de Beauvois			○	○	6/29-7/24
<i>nigripes</i> Wiedemann	x	x	x	x	6/2-9/5
<i>pallidescens</i> Philip	○	x	x	x	5/31-8/3
<i>petiolatus</i> Hine	○			○	6/23-8/29
<i>proximus</i> Walker			○	○	7/5-8/30
<i>pumilus</i> Macquart	○	○	x	x	6/2-7/11
<i>quinquevittatus</i> Wiedemann	x	x	x	x	5/28-9/28
<i>reinwardtii</i> Wiedemann	○	○	○	○	6/15-7/26
<i>sackeni</i> Fairchild	x		x	x	6/29-9/28
<i>sagax</i> Osten Sacken	x		○	○	6/20-7/11
<i>similis</i> Macquart	x		○		5/30-9/12
<i>sparus milleri</i> Whitney	x	x	x	x	5/25-8/24
<i>sublongus</i> Stone			○	x	6/22-8/30
<i>subsimilis</i> Bellardi	x	x	x	x	5/11-10/10
<i>sulcifrons</i> Macquart	x	x	x	x	6/14-10/17
<i>superjumentarius</i> Whitney	○	○	○	x	6/7-7/27
<i>trimaculatus</i> Palisot de Beauvois	x	x	x	x	6/2-8/8
<i>turbidus</i> Wiedemann		○	x	x	6/7-7/27
<i>Hybomitra</i>					
<i>cincta</i> (F.)				x	6/21-7/27
<i>difficilis</i> (Wiedemann)	x		x	x	4/26-7/3
<i>lasiophthalma</i> (Macquart)	x	x	x	x	4/18-6/27
<i>sodalis</i> (Williston)		○		x	6/14-8/3
<i>trispila</i> (Wiedemann)	x		○	x	6/15-7/20
* <i>typlus</i> (Whitney)	○				5/30
<i>Hamutabanus</i>					
<i>carolinensis</i> (Macquart)	○	○	○		5/26-6/23

horse flies, *Hybomitra lasiophthalma*, *Leucotabanus annulatus*, *Tabanus atratus*, *T. fulvulus*, *T. lineola*, *T. melanocerus*, *T. nigripes*, *T. pallidescens*, *T. quinquevittatus*, *T. sparus milleri*, *T. subsimilis*, *T. sulcifrons*, and *T. trimaculatus* were most common. The two forms *T. molestus* and *T. molestus mixis* were found in all areas, had almost identical seasonal distribution, and cannot, therefore, be true subspecies.

As a group *Tabanus* spp. were more widespread than *Chrysops* spp. Of 25 commonly collected *Tabanus* spp., 64% (16 spp.) were taken in 3 or

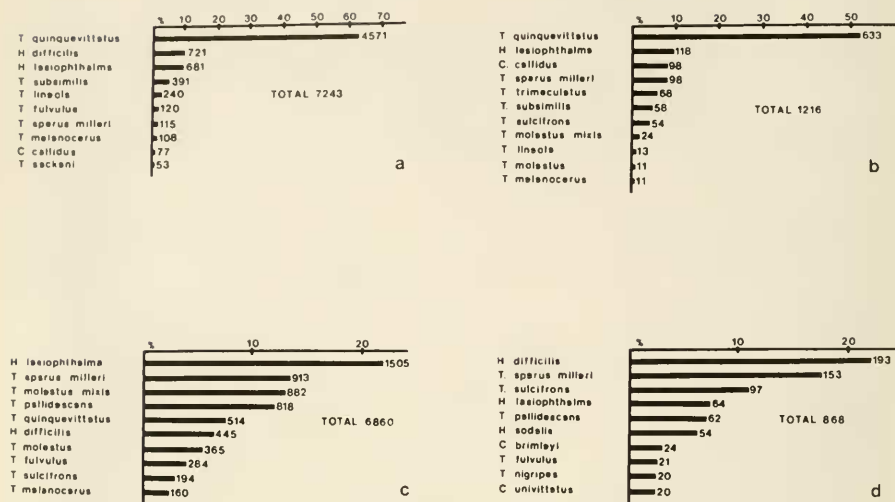


Fig. 1. Manitoba canopy trap compositions, 1978. a, Grasslands Farm, Cumberland County. b, Johnson Bible College, Knox County. c, Ball Play, Monroe County. d, Rafter 1, Monroe County.

more of the areas studied, while the same could be said of only 33% (5 of 15 spp.) of the *Chrysops*. It has been suggested that many *Chrysops* spp. may employ a waiting strategy (Thorpe and Hansens, 1978) as opposed to the more active hunting strategy of the horse flies. *Chrysops* were more likely to have been sampled less effectively in some locations due to failure of the researchers to enter their habitat or reluctance to attack a human host. The *Chrysops* spp. were not taken in large numbers in canopy traps, as was the case with some of the large *Tabanus* spp. This probably is connected to their characteristic host feeding behavior (Mullens and Gerhardt, unpublished data). Since fewer net collections were made at Ball Play, the listing of the *Chrysops* fauna for that area is less complete.

Differences in trap placement may have a major effect on overall tabanid catches. At Ball Play the 1978 catch was 6,860 specimens in 42 species, as opposed to only 350 specimens in 27 species in 1977. This large discrepancy was partly due to very poor 1977 catches of the prevalent early season species *H. lasiophthalma* and *H. difficilis*. The trap location in 1978 was less than 100 yards from those used in 1977 and probably represented a major tabanid flyway, although the second 1977 trap location appeared similar. Catches in other traps showed very similar species composition between the two years. For this reason, and because trap data are largely supported by observations of host animals (e.g. cattle), we feel that the tabanid populations in the four study areas have been sampled adequately to merit some comparisons based on the 1978 data.

Species composition, as reflected by trap collections, varied greatly among areas (Figs. 1a–d). *Tabanus quinquevittatus* was by far the most prevalent tabanid in trap collections at Grasslands Farm (Fig. 1a) and Johnson Bible College (Fig. 1b) and was fairly common at Ball Play (Fig. 1c). At Rafter 1 (Fig. 1d) no specimens were trapped, but the larger valley area at Rafter 2 yielded 118 specimens (3.9% of trap total). Tashiro and Schwardt (1949) reported moist pasture sod as a common larval habitat for *T. quinquevittatus*. Of the four traps at Grasslands Farm, the one situated near large areas (over two hectares) of low, moist pasture captured over half of the specimens. Johnson Bible College also has considerable moist pasture. Ball Play and Rafter 2 have less, while at Rafter 1 there was very little of this habitat. At Grasslands Farm, *T. quinquevittatus* was observed feeding in large numbers on cattle, but only in fields near areas of moist pasture. These data and observations indicated that high populations of *T. quinquevittatus* were quite localized.

Except for *T. quinquevittatus*, trap compositions at Rafter 1 and Rafter 2 were very similar. *Hybomitra difficilis* was most prevalent at Rafter, where it comprised over 20% of the collections. Though greatly outnumbered by *T. quinquevittatus* in trap catches at Grasslands Farm, *H. difficilis* was more evenly distributed in the study area and caused more discomfort to the cattle than any other tabanid species. It was less prevalent but still common in the Ball Play area but was notably lacking in the Knox County area. The larvae of this pest are unknown, as are most aspects of its biology. It is definitely more prevalent in upland areas.

Hybomitra lasiophthalma was a very prevalent early season species in all areas, comprising from 9.7% (Johnson Bible College) to 22% (Ball Play) of the trap catches. *Tabanus sparus milleri* was a very common species in most areas, especially at Ball Play, where it made up over 13% of the catch. *Tabanus molestus* and *T. molestus mixis* were both present in all areas, but were by far most common at Ball Play. *T. pallidescens* was quite common at Ball Play and Rafter and, together with *T. fulvulus*, caused tremendous discomfort to livestock. Both species were also present in Knox County, but only *T. fulvulus* was common at Grasslands Farm.

The major deer fly species varied among the study areas. *C. brimleyi* and *C. niger* were early season (May) pests at Grasslands Farm and Rafter, but *C. niger* was far more common in Knox County. *C. callidus* was most common in early and middle season (May and June) at Grasslands Farm and Knox County, but was quite rare at Rafter. *C. macquarti* and *C. vittatus* were common in all areas in June and July, as was *C. univittatus*. *C. geminatus* and *C. impunctus* were major pests of man and cattle at Rafter in June and July.

The largest numbers of individuals and species were collected in late June and early July. *H. lasiophthalma* and, in hilly areas, *H. difficilis* comprised

an early (May) population peak. Several *Chrysops*, including *C. niger* and *C. callidus* were also very active at that time. A minor peak occurred in late August and September, as several late season species (e.g. the late form of *T. sulcifrons*) became active and some possible second brood activity was noted for *C. callidus*, *T. subsimilis*, and *T. lineola*. The largest number of species was taken at Rafter (54 spp.). This probably reflects the tremendous habitat diversity of the Rafter area. A total of 43 species was taken at Grasslands Farm, 41 at Ball Play (*Chrysops* spp. probably slightly under-represented), and 36 in Knox County.

Seasonal distribution data for some major tabanid species are shown in Figs. 2a–h. Most species had a single, well-defined flight period of 6–10 weeks, with populations building to a peak more rapidly than they declined, e.g. *T. pallidescens* (Fig. 2a) and *T. sparus milleri* (Fig. 2b). Some species had an explosive early population buildup, e.g. *H. lasiophthalma* (Fig. 2c) and *H. difficilis* (Fig. 2d), while others were more gradual, e.g. *T. quinquevittatus* (Fig. 2e).

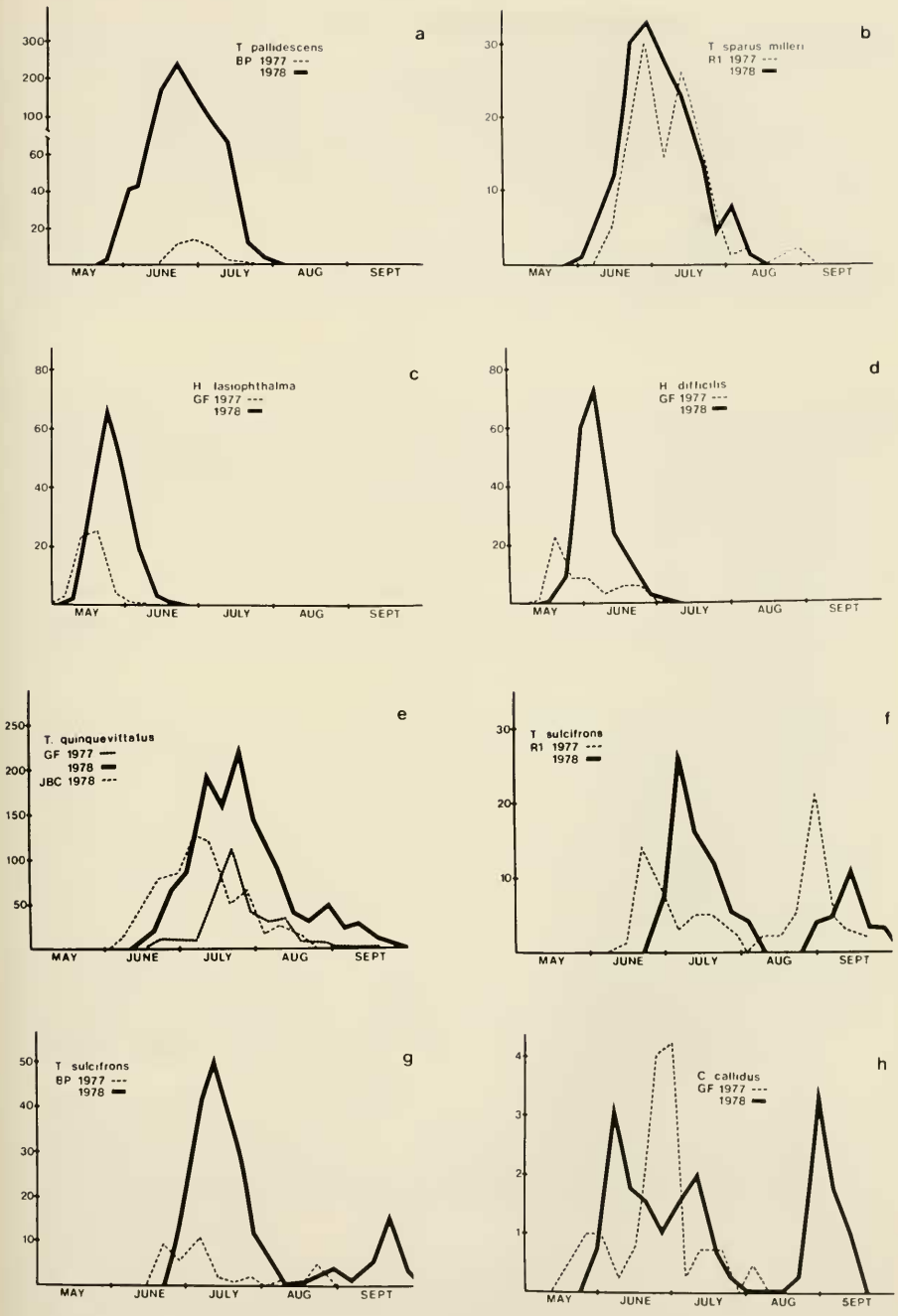
The large species currently called *T. sulcifrons* had two temporally distinct populations in all study areas, particularly in Monroe County (Figs. 2f and 2g). The general morphological appearance of these two forms differs noticeably. Dr. J. F. Burger of the University of New Hampshire, Durham, has been studying this group and believes the late season form is probably a distinct, unnamed species (Burger, personal communication).

Chrysops callidus was the deer fly most commonly collected in the canopy traps and displayed a distinct second peak possibly indicating a second brood at Grasslands Farm in 1978 that was not detected in 1977 (Fig. 2h). A very similar situation was observed for *T. subsimilis* at Grasslands Farm. *T. lineola* had a minor late season peak there both years. Though *T. similis* was not very common at Grasslands Farm, it had two apparent peaks also. One group of collections ranged from 30 May to 30 June, while the second group was taken from 5–12 September.

Some species emerged from one to three weeks later in 1978 than 1977, e.g. *H. lasiophthalma*, *H. difficilis*, and *T. sulcifrons*. This may be due to considerably lower soil temperatures in the spring of 1978. In Knox County and Cumberland County, soil temperatures in May, when many species are

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Fig. 2. Seasonal distribution of some Tennessee Tabanidae (females/trap/week). GF = Grasslands Farm, Cumberland County. JBC = Johnson Bible College, Knox County. BP = Ball Play, Monroe County. R1 = Rafter 1, Monroe County.



completing their development, averaged 3°C cooler in 1978 (18.2°C) than in 1977 (21.3°C).³

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